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ABSTRACT

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Information Technology: Opportunities and Challenges

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INFORMATION TECHNOLOGY: OPPORTUNITIES AND CHALLENGES

Chih Wang*

Abstract

This article begins with an introduction to recent developments in information technology, including the investment activities relative to the technololgy in Europe, Japan, and the United States. It then deals with the challenging issues of access to electronic information of the U. S. government, fee or free for electronic information in publicly supported libraries, U. S. federal regulations, intellectual property, and other concerns. It devotes a lengthy discussion on the argument of public goods vs. commercial commodities in the treatment of government information. It covers the issues of the OMB Circular No. A-130 and the responses it has prompted.

With regard to the fee issues, the article presents the viewpoints of both sides of the debate between charging and not to charge for electronic information in publicly supported libraries. It also reveals the conflicts in the library profession pertaining to fees for information. In the third area, the article discusses the issues of how electronic publishing should be treated, authorship, copyright, personal privacy, transborder data flows, information liability, etc.

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INFORMATION TECHNOLOGY: OPPORTUNITIES AND CHALLENGES

Very recently, world politics has changed dramatically. The Soviet Union and the Eastern Bloc have been paralyzed by unprecedented internal political and economic turmoil. On the other hand, Japan and Western Europe are maneuvering their economic forces and launching a concerted assault on the world marketplace. This radical change has shifted the focus of the world powers from the hot or cold war between the west and the east to the economic competition among the developed nations.

In the new world, the power of a nation will depend upon its industrial development and economic strength rather than the size of its nuclear stockpiles. In turn, the success of the new development of a nation will rely upon not only its control of natural resources, but most importantly, upon its holding of information resources -- knowledge and ideas. It is a new era of the microchip and the optical fiber, which has replaced the old era of assembly lines and energy reserves.

In response to the new reality, both Japan and the European Community has invested enormous sums in emerging technologies such as high-definition television, super computers, artificial intelligence, sophisticated workstations, and many others. Specifically, Japan's Nippon Telephone and Telegraph Company has embarked on a

massive $240 billion capital improvement program aimed at bringing integrated network services to every business in every city of Japan by the early 1990s. And France's government-owned telephone company has invested almost $2.5 billion since 1981 in network improvements, including the free distribution of millions of "minitel" terminals to consumers across the country.[1]

In recognizing the vital importance of the new technology and in awakening to the dramatic actions taken by Japan and Europe, the United States has also begun planning to spend about $2 billion per year on research of high performance computing and on the development of the National Research Network. It is expected that the development and linkage of super computers will eventually construct the information superhighways of the future. It is envisioned that the new computers will be able to study various scientific and medical imaginations, to creat new engineering and mechanical designs, and to access information thousands of miles away with accurate and vivid details. "A surgeon in Nashville can send a CAT scan picture to a colleague at the Mayo Clinic and get a second opinion instantly." "A particle physicist in California can check up on an experiment being run at Fremilab in Illinois without having to leave his office."[2,3]

In reality, the information superhighways originated in 1960s, when ARPANET was created to advance networking and data communications R & D and to develop a robust communications network that would support the data-rich conversations of computer scientists. Later, other specialized networks such as ESNET, CSNET, NSFNET, BITNET, Usenet, etc. were developed among many research communities.[4] Recently, the United States government has taken the initiative to

support the development of the National Research and Education Network (NREN).

As part of the High Performance Computing project, NREN is projected to cost $400 million during the first five years. It is expected to link together thousands of campuses and research laboratories, providing its users with high-speed access to enormous resources of computing power and enabling them to exchange huge quantities of computerized information. Its transmission speed is projected to reach 3-gigabits per second by 1996. The current state-of-the-art capacity is 1.5 million bits per second, a speed capable of sending about fifty pages of text per second.

When the high speed is realized, NREN will be able to transmit 100,000 typed pages, or the text of an entire Encyclopedia Britannica, in a second. In addition to bibliographic data, NREN will also be able to transmit three-dimensional x-rays, CAT scans, satellite photographs, etc.[5,6] This capability will make it possible to transfer the information contained in a library to anywhere within only a few minutes. It will certainly provide access to online public catalogs in various libraries and other information resources of special projects for library users.[7] Eventually, NREN will become the "virtual library" that combines an on-site collection with an electronic network.[8]

The advancement of the magic information technology will indeed facilitate electronic publishing and access to information whenever and wherever it is needed. Arising with the new technology, however, are many challenging issues. Jerry Borrell,[9] Karl W. Brimmer,[10] David Payton,[11] Richard M. Neustadt,[12] Frances M. McDonald,[13] and many other authors have discussed these issues and their concerns.

This article reviews and summarizes three major issues: (1)access to electronic information of the federal government, (2) fee or free for electronic information in publicly supported libraries, and (3) federal regulations, intellectual property, and other concerns.

Access to Electronic Information of the Federal Government

In principle, the First Amendment to the U. S. Constitution and the later enacted Freedom of Information Act (FOIA) are the foundations for U.S. information policy. The First Amendment provides freedom of expression to all American citizens. Under this fundamental law, citizens are free to speak or to write should they wish to do so. The FOIA renders to citizens the right to know. With this act, citizens have an open opportunity to hear or to read if they wish to.

The underlying logic is simple and commonly understood: the U. S. government is created by and for the people; for governing their own wellbeing, people must be free to express their opinions. In this democratic government, people are their own governors; they have to have full knowledge of governmental activities for effectively running and controlling their government. James Madison stated the logic very clear: "Knowledge will forever govern ignorance; and a people who mean to be their own governors must arm themselves with the power which knowledge gives."[14]

Traditionally, the federal government has been given the role of maintaining the above principle. The Government Printing Office and the Depository Library Program were created to be charged with the functions of printing and disseminating of information generated by various governmental branches. However, the basic principle of

information policies has been diverted by the recent legislation and governmental regulations.

In response to the huge federal deficit and enormous increase in federal information, the Paperwork Reduction Act was introduced in 1980. The act was enacted "to reduce paperwork and enhance the economy and efficiency of the government and the private sector by imposing federal information policy making." It is designed to reduce and standardize the data collected by agencies, making government statistical gathering and publishing efforts more economical. It requires approval from the Office of Management and Budget (OMB) when an agency wishes to collect a new type of data.

In order to implement the above act, the OMB issued in 1985 its Circular No. A-130, Management of Federal Information Resources. The Circular recognizes that the federal government is the largest single producer, consumer, and disseminator of information in the United States, and that government information is a valuable national resource. It permits federal agencies to collect or create only information which they need to perform their functions, and requires them to give public notice before initiating a new, or terminating an existing significant information service. It advocates use of the private sector for dissemination, or cost-recovery, where that is not possible.[15]

In 1989, the authorization for the Paperwork Reduction Act expired. A legislative action is now under way to reauthorize the act. In the meantime, the OMB has issued two notices inviting public comments on revising the Circular No. A-130. The library community and other civic groups oppose the federal government using the act and the Circular as mechanisms for controlling the free flow of

information in a democratic society, and particularly object to the contents of the Circular, which has prompted a series of reactions from the library profession.

First, the American Library Association (ALA) sponsored a group of "representatives of 20 national organizations" gathering in Washington, D. C. "to fight ... restrictions on access to" federal information.[16] The ALA Commission on Freedom and Equality of Access to Information concurrently published a report, which was developed at the same time while the OMB Circular No. A-130 was originated. The report "evaluated the challenges to the American ideal of individual freedom and equality of opportunity," and considered "the role of libraries in relation to freedom and quality of access to information."[17]

The Federal Library and Information Center Committee also called a meeting and dicussed federal information policies. Harold C. Relyen, Congressional Research Service Specialist, warned in the meeting that "freedom of information might be sacrificed in the holy cause of efficiency, economy, and budget balance."[18] Later, the Association of Research Libraries Task Force on Government Information in Electronic Format expressed its "concerns about access to and discrimination of information in electronic formats," and called attention that "electronic government information has not yet been distributed to depository libraries."[19]

The central issue has been about whether government information should be treated as an economic commodity to be bought, owned and sold for profit, or as a public good available for free to all citizens. Traditionally, the library profession has favored the latter view. The reasons are simple: (1) government information is col-

lected and created with the support of taxes from citizens, and (2) the U. S. government is "of" the people; government-generated information belongs to the public.[20] Ideologically, librarians do not agree with fees for, and commercialization of, government information. They worry that charges for information and government run by for-profit corporations will alter the free flow of information in a democratic society.

As Major R. Owen, a librarian Congressman, puts it, government information is as vital to a democratic government as the air[21] to the human life. Any restriction on, or barrier to, access to government information will choke off democracy just as the blocking of our breath will end our life. And as a manufacturer of chemical products has to inform the factory workers of toxic chemical hazards in the workplace,[22] a democratic government has the responsibility to inform its citizens of what it is doing.[23]

When government information attaches with a price tag, the result will always be that "he who pays the piper calls the tune."[24] While the Circular places emphasis on efficiency and economy, it has overlooked that the value of serving many social needs is incalculable. Certain government information, particularly in the health and medical fields, is related closely to "the very health of the nation's citizenry." The access to this information may make "the difference between life and death."[25]

The privatization or commercialization of government information advocated by the Circular may be more efficient in the short term purpose. However, the fact is that all private or commercial corporations are profit oriented. They will not serve the social needs when they cannot make a profit. In addition, when government

information is in the hands of private corporations, it may become their private property to serve special political ends. What will happen to the U. S. national interests if Japanese Corporations buy and run the White House and the Pentagon? Thomas Giammo, of the General Accounting Office's Information Management and Technology Division, notes on the contract-out files in the Patent and Trademark Office that the PTO's switch to electronic files was a "monster." The action "denied meaningful electronic information to the public while giving selected companies ... a virtual monopoly to market the information."[26]

Until very recently, there has been no law that mandates government generated information in electronic format to be distributed to depository libraries. The Printing Act of 1895, codified as Title 44 of the U. S. Code, deals only with printing, "standard ink on paper production".[27] It did not include the dissemination of "data in a computer that had not been reduced to a published format."[28] In 1984, a U. S. Congress Ad Hoc Committee published its final report on the Provision of Federal Government Publications in Electronic Format to Depository Libraries.[29] In 1989, U.S. Congress introduced a bill requiring that "electronic databases of an agency shall be available in useful electronic formats...."[30] Following the bill, the Government Printing Office received congressional approval to implement a CD-ROM and online dissemination pilot project.[31]

It seems that the bill has opened the door for the depository libraries to receive government information in electronic format. OMB, however, still believed that "it is not clear that agencies at present have a legal obligation to make electronic information products available to depository libraries,"[32] while it was revising

its Circular No. A-130. Even when these products will be eventually available to depository libraries, it is expected that "a cost-of-dissemination policy" will be applied.[33] The issue will be the possible high-cost charged for these information products.

The problem will become more and more serious when more and more government information products are converted into electronic formats. For the sake of holy economy and efficiency, the conversion or the production of these products is and will be mostly turned over to commercial corporations. This trend will certainly push the cost for government information products sky-rocketing and depository libraries out of reaching them. In fact, uptodate, depository libraries in U.S. Pacific territories have not received any government electronic information product.

Librarians are particularly concerned about the gap between the information rich and the information poor. The gap between the "haves" and the "have-nots" will become wider when one has to pay for government information. The rich will be able to buy better and faster information services whenever they are needed. The poor will be desperate for information because of the lack of money to pay for it when needed. The "have-nots" will be further handicapped for government information when it is turned over to commercial corperations, sold for a much higher price, and converted to be stored in electronic format. The poor citizens do not have not only financial capability but also computer skills for access to, and knowledge of, government information.

As a whole, the library community objects to the ideas of control, cost-efficiency, and commercialization or privatization of government information. It upholds the ALA resolution that

> ...the underlying principle of any legislative or executive action continue to be free and equal public access to the data collected, compiled, produced and published in any format by the government of the United States.[34]

The library community strongly supports the traditional presumption underlying U. S. information policy that "open availability of, and ease of access to, information ... of interest to or concerning the welfare of American citizens."[35] It believes that "only the preservation of public services, publicly supported, can assure that each individual has equal and ready access to information."[36]

In contrast to the library community's viewpoints, the Information Industry Association (IIA), leading other private industry groups, is generally in favor of the OMB Circular No. A-130. To IIA, information is only another form of a commercial commodity. Robert S. Willard, then Vice President for IIA, argues that "we are dealing in the area of economics. Choices are made following the laws of economics."[37] Based on this concept and argument, the marketplace, not a federal agency, determines information needs of society. IIA maintains that competition spurs creativity, prompts diversity, and results in increased efficiency and lower prices.

Before the Circular No. A-130 was issued, IIA had made a policy statement on meeting information needs in the new information age. The policy states that "government should not develop and disseminate information products or services that compete with those already available from ... private sector sources." It demands that government should encourage and subsidize the private sector to create products to meet the needs of critical information if these products are unavailable.[38] IIA views government competition as unfair since the prices of government information products are subsidized

by taxes and are usually lower than market prices.

IIA believes that "if goverment policies eliminate or preclude private sector competition, the result will inevitably be a less informed public."39 It advocates that government should be the last resort for providing information products or services, and government should only collect and produce but not disseminate information; the latter should be performed by private industry.40 Because of the concern of unfair competition, IIA justifies that the prices of government information products, such as National Library of Medicine's MEDLARS, be raised to the market prices.41

In reviewing the contents of the Circular No. A-130 and other recent government information policies, it is obvious that these policies have began to move away from the traditional view of information as public goods to the new concept that information is now a valuable commodity, In these policies, the terms of cost recovery, cost effectiveness, economy, efficiency, privatization, etc. conform with the ideology advocated by IIA and other industry groups. In the library and information profession, there are also voices that support IIA's position. Martha E. Williams, professor of information science at the University of Illinois, proposes the price increase for MEDLINE database. She says that the increase "lessens the skewing of the economics of the online information industry...."42

Sarah Kadec and Antonio Jover of U. S. Environmental Protection Agency tell the story of the privatization of the Chemical Information System. They cite that the issue of financing the system and the pressure from IIA in the Congress led to its transfer to the private section. They conclude that in response to the present changing conditions, when government databases are fully developed,

they should be transfered in order to provide services more cost-effectively.[43] Bruce Morton, Head of Reference Department at Montana State University, notes that government information, like power utilities, national parks, and forests, is national resource, that is "too important to go unmanaged...." If it is "to be managed reponsibly and effectively, both the public and libraries are going to have to show a willingness to pay the price."[44]

Fee or Free for Electronic Information in Publicly Supported Libraries

The issue of public goods vs. economic commodities towards government information in electronic format extends to the issue of fee or free for electronic information in publicly supported libraries. The overall fee issue in public libraries involves the legal, economic, and political processes that prevail in the public-policy environment. It is so complex that Pete Giacoma has devoted an extensive work to the discourse of The Fee or Free Decision.[45]

The confrontation between fee and free services was touched off when Wisconsin initiated charges for computer searching in public and academic libraries in 1984. One group of librarians in the dispute argued that "if we don't charge for the service, we can't afford to provide it." Another group countered that "if you charge for online information service, the people who need information most and who rely on their libraries to obtain it will be cut off from access" to information.

Later, the action of Online Computer Library Center's (OCLC) copyright of its online union catalog added more fuel to the confrontation. The fact was that Wisconsin's libraries were divided into those that have OCLC and those that do not. The "haves" were

forbidden by OCLC's copyright to share data with the "have-nots." Wisconsin's Council on Library and Network Development, however, maintained that "publicly supported agencies and libraries ... have a responsibility to make available to other agencies and to the public the information created by their staff."[46]

Supporters of free services stand on the ground that public libraries serve political, social, economic, and cultural purposes. Those who favor fees echo the position of the social Darwinists maintaining that "it is inappropriate to subsidize some individuals at the expense of others."[47] They also argue that fees encourage efficient use of public resources, fees limit waste and overconsumption, fees promote service levels based on need and demand, escalating service costs make user fees a necessity, etc.[48] Indeed, Brian Nielsen did find in a survey that fee-base librarians had been more responsive to searchers' need than the free-based librarians, although they have spent more time doing clerical work than their counterparts.[49]

In reviewing the arguments for and against charging a fee for electronic information, Dean Burgess, Director of the Portsmouth Public Library, compiles a checklist of reasons for charging fees. He then cites the 1977 ALA Resolution that "charging of fees and levies for information services, including those services using the latest information technology, is discriminatory in publicly supported libraries...." In conclusion, the author's position is that "the library services must be free," and that "there is a clear benefit to our nation in free service and a clear tradition and a moral imperative for us to supply it."[50]

Ronald A. Dubberly, Librarian of Seattle Public Library, is

openly against user's fees for online information in publicly supported libraries. He believes that "such fees create economic and psychological barriers for many ... users," and proposes alternative means other than user fees to support computer-assisted information services. He announces that "fees are a nightmare," that "a fee public library is not an acceptable substitute in free society," and so that "user fees should be rejected."[51]

Evidence indicates that fees are a possible barrier to online information services. Mary Huston reports that demand for online searching was greater when no fees were charged and that a significant drop in demand occurred when fees were imposed.[52] The end-users surveyed by this writer have also indicated their worry about high cost in using online databases.[53] Barbara Smith of Conoco, Inc. in Houston, Texas, agrees with Dubberly's opinions. She also favors seeking "a strategic approach to online user fees." In her words, "a public library's decision to provide online services should be driven by its goals and objectives," and unless it is willing to modify its mission, "the charging of user fees is inconsistent and unsupportable."[54]

On the extended issue of public goods vs. economic commodities, the library community seems, again, unanimously opposed to charge a fee for online information services. A report has demonstrated that ALA, the Medical Library Association, Special Libraries Association, and other organizations protested the Federal Communications Commission's proposed access charges to enhanced service providers.[55] In reality, Mary Jo Lynch, Director of ALA Office for Research, concludes in a survey that "over 70 % of responding libraries charge fees.... Almost all university libraries charge fees...."[56]

Moreover, evidence indeed indicates that a discrepancy on the fee issue exists within ALA itself. In spite of the fact that ALA, in principle, supports freedom of access to information, its Reference and Adult Services Division has sponsored a conference and published a book entitled Dollars and Sense.[57] Both the conference and the book are practically intended to devise ways and means and to advocate how to charge users for online services. John Berry, Editor-in-Chief of Library Journal, reveals in an editorial the fact that the ALA's Planning Committee has proclaimed a new attitude: "fees are not a barrier to library access and service." In Berry's opinion, ALA is yielding the principles of librarianship to current practices.[58]

Federal Regulations, Intellectual Property, and Other Concerns.

The emergence and convergence of the new technologies of computers, telecommunications, and television has blurred the market of transmission, broadcasting, and publishing; and, in turn, brought forth numerous regulatory and legal issues and other social concerns. The issues and concerns are very complex because they involve a wide array of communications media. The late Ithiel de Sola Pool has a work specifically devoted to the discussion of these challenging issues.[59] This section deals with some of these issues.

With regard to the federal regulations, the major issue is how to treat electronic publishing. By their nature, electronic publishing products are generated by computer manipulations; they may be "published" or "broadcasted" over television or computer screens. When texts or databases are so "published," they look like and are used as print press. Should these texts and databases be treated as

broadcasting or print products? If they are print press, the electronically published media, like a print newspaper, will have the right of freedom of expression provided by the First Amendment to the U. S. Constitution.

The dilemma is that, in reality, these media are "broadcasted" on television or computer screens. They are, like other television programs, broadcasting products. If they are treated as regular broadcasting programs, they will have to subject to the regulations of the Federal Communications Act. If so, the operation of electronic publishing will then be regulated by the content, economic, and structual rules of the act. These rules are basically drafted to serve the public interest, encourage competition in the marketplace, and emphasize diversity in the sources of information.[60]

The problem will particularly arise when texts or databases appear in a variety of media, and when they are treated differently. It is unfair that the two versions of same information are treated differently. The issue is further complicated by the diversity of electronically published products. There are teletexts, videotexes, one-way and interactive broadcasting, transmission via open air, regular telephone lines, cables, etc. The Communications Act has so far had no clear policies to cover these different electronic media. The serious issue is that the unfair, or lack of, regulations may hinder the development of, and the users' access to, the information products offered by the innovative technologies. Richard M. Neustadt, et al. offer their suggestions that the different regulations contained in the act be avoided for electronic publishing except for a few limited content rules. According to these

authors, the federal government should exercise the structural policies of the act to promote diversity in information sources,[61] rather than impose other unnecessary regulations on electronic publishing to block it from further development.

The second major issue is the concern that the recent government deregulatory movement may permit the foreclosure of minority views from the air because of the nullification of the fairness and equal-time provisions and the elimination of must-carry and public access and leased-channel requirements. The content regulation of the Communications Act requires broadcast licensees to give equal opportunity to political candidates for federal offices, to treat fairly controversial issues of public importance, to cover issues of local interests, etc. Opponents of the regulation imposed on electronic publishing argue that the fairness doctrine and must-carry theory were introduced when the broadcast spectrum was considered scarce. Today, the advancement of technology has proliferated various media outlets and has undercut the justification of the regulation for electronic publishing.[62]

The third concern is that deregulation may result in many interlocking multinational conglomerates that will own both hardware and software including publishers, computer companies, data processing services, television networks, newspapers, and the like. If federal policies allow this reality to occur, the availability of information providers will be reduced and the competition in the marketplace will be threatened. In turn, these giant conglomerates will then begin to dominate information business, charge excessive rates for their products, provide information on a discriminatory basis, and impose their views on the public.

The entry policy, limits on horizontal integration, and limits on vertical integration of the structural regulation in the Communications Act were formulated based on the perspective of unfair competition. The possible discriminatory practice of information conglomerates also led Neustadt, et al. to suggest that the federal government maintain structural regulation to promote diversity.[63] It seems that a court decision in 1987 prohibiting the entry of Bell Operating Companies into information content services[64] reflected the public concern in this area and supported the suggestion proposed by Neustadt, et al.

The issues pertaining to intellectual property involve authorship and copyright. With regard to the authorship, one interesting question is: can machines be considered as authors for computer-generated information databases and other works? Specifically, who should be the author for the volumes created at the Grand Academy of Lagado described in the Gulliver's Travels by Jonathan Swift:[65] the wired wood engine, the young students employed for operating the machine, or the professor who invented the machine? Recently, Meredith Merritt considers Ractor, a computer program, as the main author of a work entitled The Policeman's Beard Is Half Constructed generated by the program.[66] The Library of Congress has not, according to the OCLC cataloging records, accepted the computer program as an author. With the development of artificial intelligence and supercomputers, many databases, texts, and works of fiction can be manipulated and created by computers. The challenging question is: who shall be credited for the authorship of these creatiions?

Copyright is granted to authors for the creation of certain classes of works. The rapid change of information technology, how-

ever, has challenged the authority of the law. In foreseeing this challenge, the Center for Technology and Administration of the American University sponsored a symposium in 1967 to deal with copyright issues and the emerging technology.[67] Generally, a work that is fixed in a tangible medium of expression is protected by the copyright law. On the basis of this principle, when the copyright law protects the rights of print publications, it also protects those works in electronic form, even though they have no print counterparts,[68] including electronic databases [69] and "all forms of computer programs."[70]

The problem in applying the copyright act to the media of new technology is that the infringement of the law is not easy to detect. Pool notes that "in electronic publishing, copying does not require print. One needs simply provide computer access. One prints to read, not to copy."[71] In the case of databases, one "can easily download extensive portion of data from databases for free use without detection by suppliers."[72] Even if the action is detected, the fair-use provision of the act allows one to download large portions of the data for personal use. The problem is to determine how much downloading is fair use, and how much extensive downloading is copying.

In addition, copyright is supposed to protect from the illegitimate use of a fixed "expression," not the underlying "idea" of the expression. The difficulty is to distinquish between "expression" and "idea" in computer programming. It is also not easy to decide if a program is "original" or "substantially similar" to another one, especially when the programmer has had a chance to "look and feel" the second program.[73] Another serious challenge to the copyright

law relates to satellite dish and videotaping technology. The new inventions "effectively deprive the copyright owner of control over the use of his work...."[74] A more challenging question is whether computers will infringe the copyright law or not if computer hackers manipulate them to do so.[75]

The advancement of information technology has caused as well many other concerns, such as those pertaining to personal privacy, transborder data flows, information liability, etc. In respect to the personal privacy, the issue is that the new technology can collect, compile, and store huge data relative to personal backgrounds, behaviors, and actions. These data may be used by commercial companies and government agencies[76] without the awareness of individuals, even though the Privacy Act asserts that "information obtained for one purpose cannot be used for other purposes."

The issues of transborder data flows involve economic concern, national sovereignty and security. Many nations are attempting to establish their own indigenous computer and communications industries. The different standards for hardware and software as well as protocols for communications developed in different nations will certainly become barriers for transborder data flows. Many countries also worry that substantial domestic revenues will be lost if they permit their information needs to be transmitted by, processed, and stored in foreign telecommunications and computer systems. These countries are concerned about the sabotage and foreign control of information when the needed data are stored in other countries. They want to protect the integrity of their own cultures, societies, and political structures. A study conducted in Canada advocates that "the government should act to regulate transborder data flows"

to ensure that Canada does not "lose control of information vital to the maintenance of national sovereignty."[77]

In the U. S., the traditional assumption is that "if the work is not done here, and written in English, it is not worth knowing about." This arrogant attitude has led the federal government to enact various laws for barring transborder data flows. Based on national security, the Invention Secrecy Act of 1951; the National Security Decision Directive 189; the Export Administration Act of 1979; the Executive Order 12356, National Security Information of 1982, etc. particularly pose tight restrictions on the access to the U. S. scientific and technological information. The long-term negative impacts of national security controls on scientific information are the stagnation of basic science and academic inquiry, deleterious effects on the economy, and so on.[78] This writer has had personal experience that the restricted policies have affected Guam and other U. S. territories to receive untimely and improperly computer and information technology from the U. S. mainland because of misinterpretation of the policies by many distributing companies.

Librarians and information providers, unlike engineers and medical doctors, have rarely been sued because they provide faulty or inappropriate information to their clientele. The situation has changed in recent years when information has become a valuable commercial commodity. The Dun & Bradstreet, Inc. vs. Greenmoss Builders, Inc. case decided in the 1984-85 Supreme Court session particularly alerted producers and information suppliers. In this case, Dun & Bradstreet, Inc. was ordered by court to pay Greenmoss Builders, Inc. punitive and compensatory damages for an inaccurate credit

report on the listing company.[79]

The Dun & Bradstreet case has highlighted the information liability issue. The problem is that there is no comprehensive legislation or extensive case law dealing with the liability issue relative to using the new technology for providing information. As a result, information providers are uncertain of their legal rights and obligations. The uncertain situation may cause the entrepreneurs to hesitate to enter, or even to be scared away from, information business.[80]

The new information technology has brought to today's world many great possibilities for capturing, storing, transmitting, and manipulating information. There are, at the same time, many social concerns, legal issues, and other problems coming along with the new technology. The real challenges, as Pat Molholt of Rensselaer Polytechnic Institute states, are that of "... providing fair and equitable access, including appropriate cost mechanisms; and of working out the policies and politics...."[81] The responsibility of seeking solutions to meet these challenges will rely upon the cooperative efforts of government officials, legislators, library and information professionals, information providers, and information users.

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